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A PERIODICAL SURVEY OF NEW DEVELOPMENTS IN THE CONTROL OF PESTS, DISEASES AND WEEDS

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EDITORIAL

We welcome, amongst other contributions to this number, an article on a pest of fruit trees in Italy which represents a new problem in South Europe and one on which little has been published up to the present. We include also articles from workers in Spain and France on problems connected respectively with the important littoral citrus industry in the former country and the control of weeds in young lucerne. Readers will no doubt also be interested in an important contribution from India on the subject of the control of the destructive sugar-cane leaf hopper in that country.

We are grateful to these and past contributors to this journal for their collaboration and hope that workers overseas will continue to use this journal as a medium of expression of their experiences and opinions on matters relating to the cultivation of crops and the suppression of pests, diseases and weeds.

USE OF DDT AND BENZENE HEXACHLORIDE TOWARDS THE CONTROL OF SUGAR-CANE LEAF-HOPPER (*Pyrilla* spp.) IN UTTAR PRADESH

By B. D. GUPTA & P. N. AVASTHI, Shahjahanpur, India.

Reprinted from the Proceedings of the First Biennial Conference of the Sugar-cane Research Workers by kind permission of the Indian Central Sugar-cane Committee.

INTRODUCTION

PERHAPS no other sugar-cane pest has received more publicity in the North Indian sugar-cane belt than the sugar-cane leaf-hopper—Pyrilla. In Uttar Pradesh it is locally known as 'AL' to the farmers in the western districts, where it has occurred in epidemic form several times during the last two decades. Its devastating effect on the yield, sucrose, purity and ultimately on the recovery of sugar and gur cannot be easily overlooked. Much about it has already been published by the senior author in the *Indian Farming* (1948) in an article on 'Control of sugar-cane leaf-hopper (*Pyrilla* spp.) in the U.P.', wherein the cultural and mechanical methods of controlling this pest have been described. They are briefly reviewed in the following :—

1. Burning of cane trash, removal of the stubble and ploughing up of the cane fields after harvest.
2. Removal of the sprouts of the stubble, once at the end of April where ratooning is desired.
3. Destruction of eggmasses or the removal of the two lowermost egg-bearing leaves during April and May.
4. Bagging of adults and nymphs in hand nets during the pre-monsoon period (March to June) and killing them in kerosinised water, and
5. Stripping of dry leaves during September and October.

These methods, when applied on a co-operative basis on a large scale, have proved their worth beyond doubt; so much so, that the Pyrilla epidemic of 1947 in the western U.P. was completely stemmed and brought to a minimum before the commencement of monsoon rains in July, 1947.

It was in June, 1947, that we came across samples of DDT and Benzene Hexachloride, and preliminary trials were carried out at Simbhaoli and Daurala in Meerut District. Later, an opportunity was had to confirm the previous findings at Shahjahanpur where Pyrilla assumed an epidemic form during the post-monsoon period. Results of these trials have been published in the Annual Report of the Sugar-cane Research Work in U.P. for the year 1947-48.

Recently an article by Cheema and Sandhu regarding the control of Pyrilla by ' Gammexane ' DO25 published in the June, 1949, issue of the *Indian Sugar* and an anonymous letter regarding the use of DDT published in the August, 1949, issue of the same journal have created a controversy regarding the effectiveness of DDT suspensions and doubts about the efficacy of ' Gammexane ' DO25. As we were probably the first in India to try the two chemicals in the control of Pyrilla, it is expected of us that at this stage we should reproduce the data available with us on the effectiveness of the two insecticides for the information of the growers and others who are interested in the welfare of the sugar industry.

The organic insecticides used in these trials were :—

1. DDT 16% emulsion from Lyall, Marshall & Co., Calcutta.
2. DDT 50% wettable powder (No. 550) from Geigys Insecticide Ltd., Bombay.
3. Benzene Hexachloride from Imperial Chemical Industries (India) Ltd., Kanpur.
   as (*i*) ' Agrocide ' 2 (3.5% BHC having 0.46% active gamma isomer).
   (*ii*) ' Gammexane ' DO25 (5% BHC having 0.65% active gamma isomer.)

The spraying was done with ' Mysto ' compressed air sprayer while dusting was carried out by means of 'Peerless' rotary dusting machines.

The population of Pyrilla adults and nymphs was ascertained before the application of the sprays and dusts and also a few days after by recording the number of nymphs and adults on 20 plants in net plots varying in size from $\frac{1}{4}$ to $\frac{1}{2}$ acre, as well as by judging the increase or decrease in the Pyrilla population as a whole in the plots. The effects of the chemicals on the foliage were also noted.

TRIALS WITH DDT

A—16% DDT EMULSION.

Experiment No. 1.

This experiment was laid out in the Pyrilla infested ratoon crop of Co. 312 belonging to the cultivators near the Daurala Sugar Factory (District Meerut) on the 14th June, 1947, in scattered plots of 0.6 to 0.9 acre size. The various concentrations of DDT used were on the recommendations of the suppliers of the chemicals, viz.,

(*i*) One gallon of 16% emulsion in 14 gallons of water.
(*ii*) One gallon of 16% emulsion in 25 gallons of water.
(*iii*) One gallon of 16% emulsion in 50 gallons of water against

control where no spraying was carried out. The trial was conducted on non-replicated basis.

Results

The population of Pyrilla nymphs decreased considerably on the 6th day after spraying in the treated plots while no appreciable decrease was observed in the control plots. The lower leaves of the plants had become slightly pale under higher concentrations of the DDT emulsion. Treated plots were almost free of Pyrilla during the last week of June when the control plots had a heavy infestation as before. Also as shown in the table there were apparently no significant differences among the results obtained with the different concentrations of DDT. Even 1 in 50 seemed quite effective as 1 in 25 or 1 in 14.

Experiment No. 2.

Effectiveness of 16% DDT emulsion in proportion of 1 : 50 with water was further examined by carrying out a replicated field trial in the cultivator's field on 24th June, 1947, in the same locality. The data obtained from this experiment are shown in Table I. They confirm the previous findings regarding the effectiveness of DDT emulsion.

Experiment No. 3.

Large scale application of 16% DDT emulsion was carried out at the Sugar-cane Research Station, Shahjahanpur, during the months of October and November, 1947, when the entire crop all over the farm had severe infestation of Pyrilla.

Results

The material sprayed retained a good deal of its toxicity even after two weeks of spraying, but it has been observed that it is slow to act and it was only on the 3rd day that an appreciable decrease in the population or the insect mortality could be noted in the treated plots. The population of Pyrilla adults and nymphs continued to decrease in most of the plots. At a few places, however, the number of nymphs slightly increased. This was due to the hatching of eggs from sheltered places in the leaf sheaths. This increase was almost negligible in comparison to the enormous increase observed in the untreated plots. This shows that the hatching period of the eggs was completely covered by the insecticide in plots where DDT was sprayed.

B—DDT 50% WETTABLE POWDER (Geigy's No. 550).

Experiment No. 1.

Trials with 50% DDT dispersible powder were carried out at the Sugar-cane Research Station, Muzaffarnagar, during June, 1947. The population of Pyrilla was observed to be 2322 nymphs per 80 plants before the application of the treatments. It was reduced to about 20 nymphs only on the twelfth day after spraying, thereby bringing about a reduction of about 98%. 2 lb. of this powder were used with 1 lb. soap in 50 gallons of water. This quantity was found to be sufficient to treat an acre of the crop.

Experiment No. 2.

DDT wettable powder was again used on a large scale at the Sugarcane Research Station, Shahjahanpur, to control Pyrilla during the months of November and December, 1947. The strength of the suspension used was the same as that used in the month of June at Muzaffarnagar. Except that instead of 50 gallons of the spray, we used 100 to 200 gallons of the spray, depending on the size of the crop.

Results.

As would appear from the Table III, there was heavy infestation in the treated and untreated plots at the commencement of the control operations on 22nd November, 1947. The population of nymphs and adults considerably decreased as a result of spraying with DDT in the treated plots in (1) while, due to the hatching of the eggs and continued changing of nymphs into adults, the number of both the adults and nymphs increased in the untreated plots up to the first week of December, 1947. In series (2) and (3), where the crop was treated during the first week of December, a reduction in the population of Pyrilla nymphs and adults was observed a week after spraying in the treated plots ; but later on a decrease in the population was noted in the control plots also. This decrease in the untreated plots was due to the lowering of the temperature due to cold and to which the Pyrilla adults are known to be particularly susceptible. The data regarding the decrease in population and the mortality of nymphs and adults observed during the first week after spraying leave little doubt regarding the effectiveness of the DDT wettable powder.

TRIALS WITH BENZENE HEXACHLORIDE

The preliminary trials with BHC ('Agrocide 2' having 3.5% BHC and 0.46% active gamma) were carried out in the first week of June at a farm adjacent to the Simbhaoli Sugar Mills, District Meerut. An area of about three acres of the ratoon crop was dusted with the chemical at the rate of 35 lb. to an acre. The knock-down effect of the insecticide was so complete that a heavy mortality of the nymphs was observed in the treated plots in about 10—12 hours. The population of Pyrilla nymphs decreased by 95 to 98 per cent after 72 hours of dusting. No adverse effect of the chemical was observed on the plants.

Afterwards another brand of BHC, ' Gammexane ' DO25 (having 5% BHC and 0.65% active gamma) was tried at Shahjahanpur in the months of October and November, 1947. It was observed that 50 to 60 lb. of the chemical was required to completely cover the entire crown of the green leaves present in the cane at this part of the season. Like ' Agrocide ' 2 this insecticide also proved very effective and brought about a complete mortality of Pyrilla nymphs and adults within two or three days. No reinfestation of the treated crop was observed till the time of harvest in January.

Cheema and Sandhu (1949) have also confirmed our finding on the effectiveness of ' Gammexane ' DO25 in the control of Pyrilla in the Punjab.

Economics of the Treatments.

The cost of applications of the treatments would always vary from place to place, depending on the nature and the density of the cane crop. It would also depend on the cost of the insecticide, the quality of labour and the wages paid to them. It has been worked out by us that during the pre-monsoon period 25 to 50 gallons of spray material is needed to treat an acre of the crop. It would require half to one gallon of the 16% DDT emulsion to treat an acre of sugarcane during May and June, while 1 to 2 lb. of 50% DDT wettable powder would suffice for the same area. The former would cost Rs. 10/- to Rs. 20/- and the latter Rs. 3/- to Rs. 6/- at the current market rates. It would also take about 36 units (one unit = work of one man in one hour), or 4 men working for about nine hours to spray an acre of the crop, costing another sum of Rs. 6/- as labour charges. Thus, the total cost of treating an acre of the sugarcane crop would be Rs. 16/- to Rs. 26/- if 16% DDT emulsion is used and Rs. 9/- to Rs. 12/- if 50% DDT wettable powder is used.

During the post-monsoon period, i.e. in October and November, about 100 to 200 gallons of the spray material will be needed to treat the cane crop of 500 to 800 maunds yield per acre. The actual quantity of 16% DDT emulsion and 50% DDT wettable powder needed to make the required volume of spray material would cost Rs. 40/- to Rs. 80/- and Rs. 11/- to Rs. 22/- respectively, while 72 labour units or 8 men working for 9 hours would be needed to spray an acre of the crop. Their wages would amount to Rs. 12/- at Rs. 1/8/- per day. Therefore, the total cost of treating an acre of sugarcane during October and November would amount to Rs. 52/- to Rs. 92/- with 16% DDT emulsion and Rs. 23/- to Rs. 34/- with 50% DDT wettable powder.

It was observed as a result of these trials that only 0.32% DDT in the 16% emulsion and 0.2% DDT in the 50% wettable powder was effective to bring about complete control of Pyrilla. This means that 16% DDT emulsion can also be further diluted to 0.2%, i.e., 1 part of the emulsion should be used with 80 parts of water. This would bring down the cost of this treatment by an appreciable amount. Even then, the cost of this treatment would remain prohibitive in comparison to 50% DDT wettable powder.

As regards the cost of dusting the crop with ' Gammexane ' DO25, the cost of the chemical on the basis of 35 to 50 lb. per acre during the pre-monsoon period works out to Rs. 16/- to Rs. 22/-, while during the post monsoon period the dusting at a rate of 50 to 60 lb. per acre would cost Rs. 22/- to Rs. 27/-. The labour charges for dusting an acre of crop would be Rs. 3/- for 18 labour units (with two men working for 9 hours) during the pre-monsoon period and it would be Rs. 6/- for 36 labour units (with four men working for 9 hours) in October and November. It is worthwhile mentioning here that it becomes difficult, if not impracticable, to dust a luxuriant and tall cane crop with a rotary hand dusting gun. It would be worthwhile to use better types of dusting machines or power dusting to increase the efficiency and to bring down the cost.

Discussion.

The effectiveness of Benzene Hexachloride ('Gammexane' DO25 or 'Hexyclan' having 5% BHC and 0.65% active gamma isomer) and 50% DDT dispersible powder used by Cheema and Sandhu (1949) in their experiments in the Punjab has been doubted by some anonymous workers in the August, 1949, issue of the *Indian Sugar*, Vol. XII, page 439. The author of this letter has further raised the question regarding the crystalline and amorphous nature of the DDT deposits on the leaf surface. His contention is that a crystalline deposit from the emulsion is more effective and rapid in action than an amorphous deposit from the suspension. He feels that the choice of DDT dispersible powder had a considerable bearing on the negative results obtained in the Punjab.

It is almost an established fact that Benzene Hexachloride has got a quick knock-down effect. As regards its prolonged action our observation is that one dusting carried out during the third week of October, when all the stages of the pest were present, eliminated all the nymphs and adults from the crop, and the absence of any reinfestation of the treated crop during the rest of the season indicated that whatever nymphs hatched out were killed. Again, in March, 1948, a wheat crop was dusted at the rate of 50 lb. per acre when the oviposition was in progress and the adult population was very high. Dusting destroyed all the adults and here again we did not come across any reinfestation till the wheat was harvested. All this leads us to believe that 'Gammexane' DO25 has also got a prolonged effect. These observations are well supported by Muirhead-Thompson (1949), who found it effective even 13 weeks after the application of the treatment.

As regards the crystalline and amorphous nature of the DDT deposits our experience is that the DDT suspension is more effective than the DDT emulsion. The results obtained by Madjinicolaon (1948) and Laplante (1949) support the observation.

It appears that the author of this letter has based his criticism on the observations of Hadaway and Barlow (1947, 1949) that crystalline deposits from emulsions are more effective towards the destruction of flies than the suspensions. This may be true for flies, but it does not hold good for Pyrilla due to the differences in the structure of the mouth parts. The mouth parts of flies are of sponging and sucking type, while those of Pyrilla are piercing and sucking. The flies are affected by contact as well as by feeding on the crystalline deposits present on the surface treated with emulsions, while in the case of Pyrilla it is the contact action alone which brings about mortality. The chances for Pyrilla of coming into greater constact with an amorphous deposit are much more than in the case of crystalline deposits.

Conclusions.

1. One part of 16% DDT emulsion with 50 parts of water and 2 lb. of 50% DDT wettable powder in 50 gallons of water are effective in destroying the Pyrilla nymphs and adults within a period of 10 to 15 days.

2. Five per cent Benzene Hexachloride ('Gammexane' DO25) having 0.65% active gamma isomer brings about a heavy mortality of Pyrilla nymphs and adults when applied at the rate of 35 to 50 lb. per acre during the pre-monsoon and 50 to 60 lb. per acre during the post monsoon periods.

3. The mortality of the insects is observed after 72 hours of spraying with DDT and after 10 to 12 hours of dusting with BHC.

4. The two chemicals, viz. DDT and BHC, remain effective for quite a long period as reinfestation was not observed in the treated plots.

5. The actual quantities of DDT required to eliminate Pyrilla amount to 0.32% in the 16% emulsion and 0.2% in the 50% DDT wettable powder.

6. There is scope for further dilution of the 16% DDT emulsion to 0.2%, i.e. one part of emulsion in 80 parts of water.

7. Twenty-five to fifty gallons of the spray shall be required to cover the foliage thoroughly during April, May and June and 100 to 200 gallons during October and November depending upon the density of the crop.

8. The chemicals are not expected to affect the foliage in the proportions in which they have been used.

TABLE No. I.

Effectiveness of 16% DDT Emulsion against Pyrilla nymphs and adults during June, 1947.

Sl. No.	Date of spraying	Treatments	No. of Pyrilla nymphs per shoot	No. of Pyrilla nymphs after spraying		% Decrease on 6th day	Remarks
				3rd-4th day	6th day		
1.	13th & 14th 6.47	One part of 16% emulsion with 14 parts of water	88	41	9	90.0	Lower leaves yellow.
		One part of 16% emulsion with 25 parts of water.	150	51	9	84.0	Lower leaves slightly yellow.
		One part of 16% emulsion with 50 parts of water.	68	10	1	83.0	No yellowing of the foliage.
		No spraying. (Control)	77	78	73	6.5	—
2.	24.6.47	1 part of 16% emulsion in 50 parts of water.	72	21	—	72.2	No yellowing of the foliage.
		No spraying (Control)	125	105	—	15.0	—

TABLE No. II.

Effectiveness of 16% DDT emulsion against Pyrilla nymphs and adults during October—November.

Date of spraying	Treatments.	Field No.	Average No. of Pyrilla nymphs and adults per cane.						Remarks
			Before spraying.		One week after spraying		A fortnight after spraying		
			Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	
20-30/10	Spraying with one part of 16%DDT emulsion in 50 parts of water.	C3/S	17	90	5	5	Nil.	Nil.	Pyrilla completely disappeared in the treated plots by the end November.
		A/4	920	103	524	26	257	38	
		G2/N	351	72	105	12	137	15	
		H/1	937	99	409	28	78	3	
	Average		556	91	261	18	118	14	
	Percentage decrease				53%	81.3%	78.7%	84.6%	
Control—No spraying		C3/S	32	88	126	135	150	142	Pyrilla infestation continued to be heavy in November and December.
	Percentage increase				291.2%	53.7%	337.5%	61%	

TABLE No. III.

Effectiveness of 50% DDT wettable powder No. 550 on Pyrilla nymphs and adults during November and December, 1947. (Shahjahanpur).

Date of spraying.	Strength	Average No. of Pyrilla nymphs and adults per plant.						% Decrease after a fortnight		Remarks
		Before spraying.		One week after		A fortnight after.				
		Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	Adults	
22/11/47	2 lb. in 50 gallons of water.	726	99	314	2	115	1	84%	99%	No effect on the foliage.
	Control . . .	524	26	550	40	760	62	+45%	+138%	
2/12/47	2 lb. in 50 gallons of water.	675	44	198	25	101	1	85%	98%	—— do ——
	Control . . .	206	11	160	18	163	3	20.8%	73%	
5/12/47	2 lb. in 50 gallons of water.	55	14	7	1	5	Nil.	99.9%	100%	—— do ——
	Control . . .	37	19	13	1	10	1	73%	94.7%	

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THE DISEASES, PESTS AND HAZARDS OF GROWING CITRUS CROPS IN SPAIN

by E. SANCHEZ BUEDO (*Agricultural Engineer*)

ALTHOUGH the cultivation of herbaceous plants has great importance in the Spanish agricultural economy, that of the cultivation of fruit trees is no less great.

The products of the first are almost entirely consumed within the country, and the only exports are early varieties of potatoes and saffron, ground pepper (cayenne pepper), onions, tomatoes and melons.

On the other hand the crops from bush and tree plantations are those which in their natural state or when processed constitute the bulk of Spanish agricultural exports and are the chief source of obtaining foreign currency, so necessary for the whole of our economy.

Amongst the very varied agricultural production of Spain, whose geographical situation, orographic and climatic characteristics make it suitable for the widest diversity of crops (from those of the sub-tropical zone to those of the cooler inhabited regions), the products best known abroad are oranges, lemons, almonds, raisins, wine and olive oil.

This very considerable importance of our fruit and shrub plantations is the reason for the great attention which agriculturalists give to their cultivation, not only in the tilling and fertilization of the soil, but also in the prevention and control of all diseases and pests which attack the crops, which not only reduce the quantity of fruit obtainable in a normal year, but which also greatly reduce the market value of the fruit obtained.

CITRUS CROPS

The areas covered by the different species cultivated are as follows :—

Oranges	70,000	hectares
Mandarines	6,600	„
Lemon trees	3,800	„
Grape fruit	60	„

The plantations extend along the coast of the Mediterranean and South Atlantic, namely from the province of Tarragona to that of Huelva (both inclusive) together with the Balearic Islands, although more than two thirds of the oranges and mandarines are grown in the provinces of Valencia and Castellon. For lemons the provinces of Murcia and Malaga are the chief ones. The bitter orange, intended for the preparation of marmalade, is planted almost exclusively in the province of Seville.

This year's production, which has begun to be harvested, will, it is estimated, reach 900,000 metric tons of oranges. In a favourable year it may reach 1,200,000 tons and in a bad one (not disastrous) it is usually below 700,000 tons. The production of mandarines varies around 30,000 metric tons and that of lemons 50,000 tons.

The potential demand for oranges from home consumers is some 400,000 metric tons, that is to say about 500,000 metric tons can normally be exported. There is little home demand for mandarines, and some 40,000 metric tons of lemons can be exported after leaving the home market well supplied.

The most serious damage suffered by the Citrus crops in this country is produced by a group of sucking insects known technically by the name " Coccids " and commonly by the name " scales and mealy bugs." These insects have their body protected by a more or less hard shell, and we will classify them according to the nature of this protective coat.

(A) with hard shield or shell,

Chrysomphalus dictyospermum (red scale).
Aspidiotus hederae (white oleander scale)
Lepidosaphes gloverii (" serpeta fina ") Glover's scale
Mytilococcus gloverii (" serpeta gruesa ")
Parlatoria ziz yphus (black parlatoria scale),

(B) with hardened tegument (false shell),

Ceroplastes sinensis (" caparetta blanca ")
Saissetia oleae (" caparetta negra ")
Coccus hesperidum (brown scale),

(C) with a powdery or waxy coating,

Pseudococcus citri (vine mealy bug)
Icerya purchasi (" fluted scale ").

These pests are not equally developed in all the regions where the Citrus crops can be cultivated. The great variety of climatic conditions and soil which characterise Spanish agriculture are reflected in the biology of numerous insects ; for example *Mytilococcus pinnaeformis* (" serpeta "), which causes such great damage in the orchards of Valencia and Castellon, does not appear in the orange groves of Murcia, Seville and Cordoba.

For many years our growers have not spared efforts or expense for the control of these pests, for they know well the influence which this has not only on the quantity of fruit harvested but more especially on the quality and good appearance of this.

The insects in groups A and B are controlled with hydrocyanic acid and with insecticides based on oil emulsions.

The control of the scale insects in group C cannot be carried out well with the above products, for the waxy or cotton covering prevents the penetration of the oil emulsions and makes that of gaseous hydrocyanic acid difficult. For this reason, biological control is chiefly used against them. The Plant Pathology Station in Burjasot (Valencia) supplies free, to any growers who apply, colonies of *Novius cardinalis*, an insect which feeds exclusively on *Icerya purchasi*. They also supply colonies of *Cryptolaemus montrouzieri*, an insect parasite of *Pseudococcus citri*.

Despite the increase in experiments on the use of emulsified mineral oils under normal conditions, preference is given to the use of hydrocyanic acid gas in the control of the above-mentioned pests, and this despite the great risk involved by its use. The staff engaged in the operations acquire excessive confidence in the manipulation of such a terribly poisonous chemical until they come to the point of forgetting the most elementary precautions.

Another disadvantage of using hydrocyanic acid is the limitation which is imposed on its use by meteorological agents : temperature and humidity (of both soil and atmosphere), light and wind. All these circumstances, as well as the vegetative cycle of the trees, reduce the time in which it is possible to control the pest to two periods in the year : one in winter—from the completion of harvesting to the appearance of new shoots ;—the other in summer—from the time when the oranges, still green, are the approximate size of a walnut to when they begin to change colour.

A great increase in expense and work is involved in the use of this insecticide by the necessity, before application, of covering the trees with special canvas tents of cotton fabric which are made in octagonal form. The moving and installation of these tents require the use of poles or rods and ropes.

Of the different methods used to generate hydrocyanic acid, preference is given to the most troublesome : that of the " jar". Some attempts have been made to replace it by the more convenient and economical system of a large-capacity and transportable generator on wheels, but growers continue to use the first method, for they find that the action of the hydrocyanic acid is more effective immediately after generation.

Compared with sodium cyanide the use of the other products which generate hydrocyanic acid gas is limited, despite the convenience in managing them and the fact that they do not need sulphuric acid or water. Thus the use of calcium cyanide either in dust form (Cyanogas) or in pastilles or tablets (Calcid) is very limited.

Our country has a factory in Valencia for producing liquid hydrocyanic acid, but this method has not been extended. The cyanides which this factory needs as raw materials have to be imported.

The serious problem which now confronts our Citrus industry is lack of sodium cyanide. It depends most exclusively on imports and in these last two years, despite the efforts of our competent

organizations, we have not found suppliers for the 1,000 metric tons which, on an average, are needed for the Citrus plantations. In order to meet this deficiency in future, great efforts are being made to produce in our country all the sodium cyanide necessary.

On the other hand the oil emulsions which were imported a few years ago, chiefly from North America and Great Britain (Volck, 'Albolineum,' Emulso, etc.,) are already being made in Spain. However, their quality still requires to be greatly improved, especially as regards unsulphonated residue and viscosity. To do this it is necessary for the Petroleum Monopoly (C.A.M.P.S.A.) to supply highly refined white vaseline oils. The casein necessary for preparing the emulsions is the only thing which it is at present necessary to import.

The oils are used generally for summer treatments.

The usual method of controlling these pests is to fumigate with hydrocyanide every two years, and in the interval to apply oil. Orchards in the most favourable position are fumigated every three years, but at the opposite end of the scale there are some which are not only fumigated annually but also sprayed with oil emulsion in summer.

From what has been said the reader can easily deduce the expense and efforts needed for the protection of a Citrus orchard. Fumigation with hydrocyanic acid at present involves a cost of 8 to 14 ptas. per tree, according to the size of it, but every grower is aware that, if he ceases this constant control, at the end of some three years the production will be reduced to 30 to 40% of what it is at present and the fruits obtained would be of very bad quality and unsuitable in appearance. Calculate the amount of this loss at the present prices of fruit, which vary from 1.60 to 2.50 ptas. per kilo.

In some years severe damage is also caused by the " Mediterranean fruit fly " (*Ceratitis capitata*). The difficulty of the present system of control (special flasks with poison bait suspended from the trees) is the reason for its not being controlled with much efficiency.

The fungus diseases which attack Citrus crops are not very important compared with pests. Some like " sooty mould ", caused by the fungus *Meliola camelliae*, are in general a consequence of the existence of " scales," which secrete a sugary material encouraging the development of the fungus, a black powder covering the leaves and fruits, which are thereby spoiled. Generally the destruction of the " scales " causes the disease to disappear ; but cuprous oxide sprays will control it even in the presence of scales.

The fungus *Pythiacystis citrophthora* gives rise to the disease called " Gummosis," manifested by the exudation of gummy matter, which is observed on the branches and trunks and at times also on the fruits. It occurs where there is an excess of moisture in the soil, preventing the normal respiration of the roots. For this reason, the soil is excavated around the trunk leaving a large part of the roots uncovered to aerate them, at the same time preventing wet soil from coming into direct contact with them. The lesions already produced on trunks and branches are scraped with a sharp knife until the healthy wood is reached. The wound is disinfected with a solution of permanganate of potash and covered finally with a layer of mastic.

In this country Citrus crops also suffer from other diseases, whose causes are not well known and which we can consider physiological : such are " *Chlorosis* " and " *Foliocelosis*." It is easy to confuse them, as the symptoms are very similar : in both of them a yellowing of the leaves is produced, but the causes are completely opposite and the remedies differ. Chlorosis is attributed to an excess of lime, and is corrected by adding iron sulphate to the soil, which it is usual to add to the fertilizer mixture. The Foliocelosis or " Vinsat " is generally attributed to a lack of lime, which is added in the form of hydrate or carbonate in acid soils, and in the form of sulphate in those with alkaline reactions (the predominant type in Citrus orchards).

This is not the end of the hazards attending the production of a good crop. There remain those due to the environment, above all weather conditions. In order to protect the orchards from winds, which are often strong and even violent, very thick hedges of cypress trees, thuyas or bamboos are planted at the boundaries. These act as protective screens either from cold winds which blow in from the interior or from the warmer winds which are, however, laden with saline substances, blowing off the sea. The same protection is used against very clayey dust from roads and paths.

Heavy rains, prolonged and continuous in spring, when the pollen is ripe prevent pollination from being carried out and ruin the crops. This was experienced in wide areas in the province of Valencia in the spring of this very year.

Equally there is the most terrible of all these enemies of the Citrus crops : frost.

Owing to the remunerative nature of this crop it has extended to regions which reach and even exceed the limit of the normal area of cultivation, in the sense that it is rare to have a year in which temperatures below 0°C. are not produced during the winter. To plant Citrus crops in these districts is a gamble, and it is logical that there should be many more losers than winners.

But orchards in the most favourable position on the coast or in the sheltered valleys are also not exempt from this danger to which the orchards in the interior are the most exposed. In severe years when the temperature falls to 0°C., falling abruptly, and when such a cold environment persists for more than an hour, particularly if it is not accompanied by moisture, disaster is certain and irremediable. The fruit becomes useless : the pulp loses its juice and is reduced to a spongy mass with a disagreeable odour.

Everyone can still remember the catastrophe which was suffered by the province of Castellon in the winter of 1946 : a cold wind from the north-east laden with fine snow destroyed a large number of plantations, for the trees themselves died and had to be cut down. Those which were not entirely killed had to be cut at the base of the trunk, to be ingrafted afresh. That year's crop was lost and those of the two following years. Up to the present year these orchards have not resumed normal production.

Madrid, *November*, 1951.

TRANSLATION

CACOECIA ROSANA, L.

by DR. GINO SALVATERRA
Ministry of Agriculture and Forests, Trento, Italy.

THE first expert to study this insect gave it the Graeco-Latin name of *Cacoecia rosana*, which means " butterfly harmful to plants belonging to the family *Rosaceae*." In fact it was first discovered in woods and pastures on numerous species of wild *Rosaceae* and principally of those in hedges and enclosures along the roads of the cultivated countryside. This is probably why the Germans commonly call this moth " Heckenwickler", which can be translated as " hedge-moth".

This species has also been found on trees belonging to various families : apart from all the *Rosaceae*, it has been found alive on *Alnus*, *Tilia*, *Quercus*, *Betula*, *Corylus*, *Urtica*, *Tamarix*, *Angelica*, *Salix*, but it has a pronounced preference for the *Rosaceae*.

However, as long as the damage was restricted to bushes, there was nothing to worry about. But later on as fruit growing increased, so as not to belie its Latin name, the butterfly turned its attention to the cultivated species of *Rosaceae*, and in particular to the apple tree and the pear tree. The damage, however, was never considerable, or, if it was, it remained localized to the large fruit-growing districts, so that farmers and experts were never alarmed by *Cacoecia rosana*.

In the last few years, however, the insect, aided probably also by favourable atmospheric conditions, extended and intensified its injurious activity in the orchards, so much so that it was reported to the Local Agricultural Authorities by farmers in various districts.

For the purpose of replying to the numerous enquiries from fruit growers who had suffered damage regarding the method of control, we consulted, in collaboration with Ing. de Peez, all the Italian and foreign literature which we could find on the subject. The information gathered was vague and contradictory. For instance, whereas the French entomologist Lhomme speaks of a second generation, others attribute to the hedge-moth only one generation. The Institute of Entomology of the Washington Department of Agriculture privately informed us that damage by *Cacoecia rosana* has been reported even in Canada, whereas in the United States the insect's activity gives no cause for anxiety.

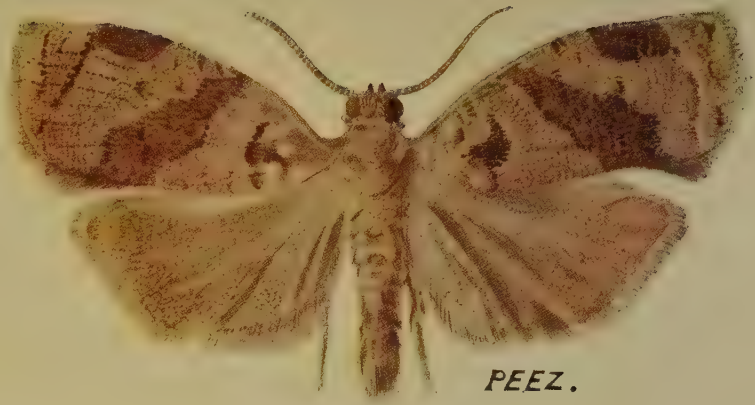

Plate 1. — CACOECIA ROSANA L. *Adult Moth*

X 8

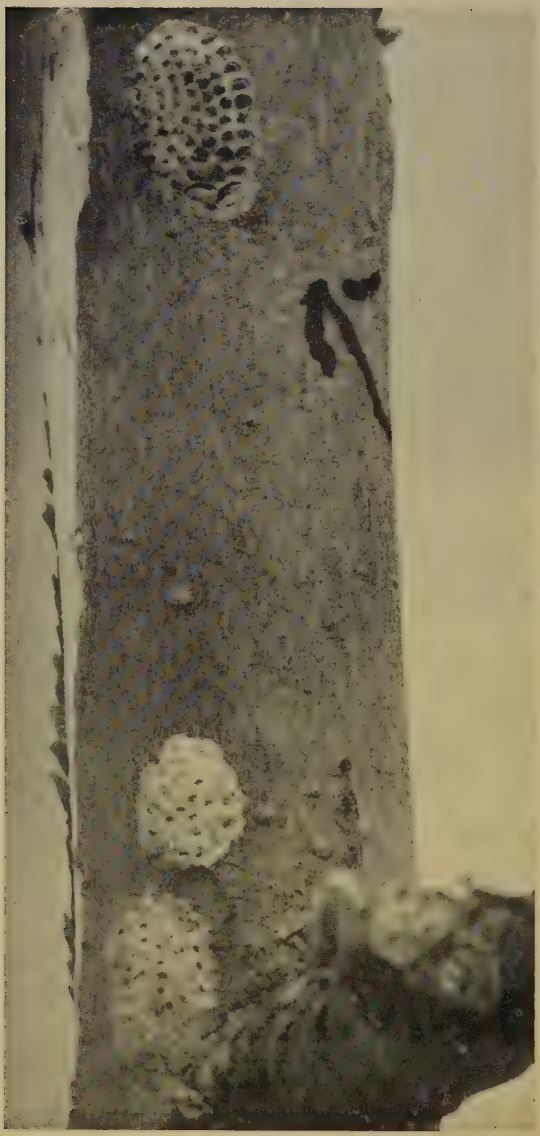

Plate 2.—Hatched eggs of *Cacoecia rosana L.* on the branch of an apple tree

DISTRIBUTION OF THE INSECT

In the Bolzano Province, the most affected area is that of Castelfirmiano—Ponte Adige and the district between Ora and Termeno. In orchards of these districts, where losses due to the presence of this new scourge were almost negligible in the years 1949—1950, recent damage caused by this insect was from 20% to 30% of the total production.

Other deadly infestations were discovered at S. Giacomo and Lana in the Val Venosta district. Damage has been reported, but much less extensive, in the orchards in the valleys of the Noce in the Trentino. At the Natural Science Museum of Trento there are examples of *Cacoecia rosana* collected by Sig. Perini on bushes in the Doss Trento, in Milan and in Upper Austria and other countries, from which it can be inferred that the insect is more or less widespread both in Europe and in America. It is therefore likely that if conditions favourable to its development continue, other fruit-growing countries will also suffer from the damage it causes.

BIOLOGY AND HABITS OF THE INSECT.

Cacoecia rosana is a butterfly belonging to the microlepidoptera group. The male, which is easily recognizable by the tuft of long hairs at the extremity of the abdomen, is smaller than the female. The wing span, which varies on the male from 14 to 17 mm., is from 17 to 23 mm. on the female. The colour varies from a grey-brown to a reddish-brown, but always very light. On this light background are the markings which are formed by a spot at the base of the wing, by an oblique band half-way up the wing, and by a spot on the outer third near the fore margin of the wing. This marking, which is often very distinct on the male, is often so pale and indefinite on the female as to become mere broken marks. The hind wings are of a light yellowish-brown with a grey shading which extends from the base to the hind margin and to part of the outer margin of the wing.

At Ponte Adige, where the insect was studied, the butterfly appears towards the middle of May. They reach their maximum numbers during the first ten days in June, and then begin to decrease as the months go by.

Fruit farming in that district has been going on for years and that is why, together with the new varieties, the old types of apple such as *Rosmarino*, *Giallo nobile*, and *Grafenstein* are grown, as are also pears of the *Moscatella*, *Butirre*, *Williams* and *Imperatore Alessandro* varieties.

The butterfly has no pronounced preference as to where she lays her eggs, and independently of the variety she chooses trees with an extensive foliage. The eggs are usually laid at the summit. During the flight period, the trees to which they are mostly attracted, and in which the butterflies are more often found, are the apple trees of the Grafenstein variety, the fruits of which give out in June a special odour due to the malic acid which turns into sugar.

This odour is attractive to the butterflies like the vinegar and sugar in the trap-bowls which the better fruit-growers hang on the trees so as to attract *Carpocapsa pomonella* and thereby decide the best time for arsenical sprayings. At the period of maximum flight, if a branch is shaken, groups of 5—10 or more *Cacoecia rosana* can be seen to fly off. This will give an idea of the spread of this destructive lepidopterous insect. In the most stricken areas the dreaded *Carpocapsa* takes second place to *Cacoecia rosana.*

The flight is uncertain; if obliged to fly away it takes refuge in the tops of nearby trees. Sometimes it will also hide in the grass beneath the trees from which, once the danger is over, it returns to the trees. It has many enemies among insects, birds and atmospheric agents, but it has been endowed by nature with a special instinct for the preservation of the species.

Notwithstanding that its sister species have two or more generations per year, in the climatic conditions of the Bolzano and Trento provinces we have been able to ascertain, together with the assistance of Dr. Pruner, that *Cacoecia rosana* has only one generation.

Three or four days intervene between the emergence of the adult and the laying of the eggs. In our district the first little heaps of eggs have been noticed towards the 25th May. More often these are laid at the bases of branches with smooth bark, and rarely on the cracked and rugged parts. We have never noticed any deposits of eggs on the new season's still hairy shoots nor on twigs of small diameter. Perhaps the hairs prevent the eggs from sticking on firmly and the narrow twigs are not suitable to receive and retain the small clusters of eggs. De Peez has made the following observations: he collected from a breeding box several pupae from the new season's leaves and twigs. When they had turned into butterflies, copulation took place, then the females laid the eggs, but they preferred the small boards of the breeding-boxes to the hairy shoots. It would be interesting to see whether they would prefer trees sprayed with ordinary polysulphides or oils which would offer a smooth bark for the laying of eggs to those treated with a raw polysulphide of a strength such as to form a rough coating on the bark of the branches.

The eggs are laid in small round-shaped clusters. Their diameter varies between 5 to 10 mm. Each cluster contains from 70 to 100 eggs laid spiral-wise and in perfect order, each within an alveola. The female deposits a greenish liquid all over the heap of eggs. We do not as yet know whether this is for winter protection of the eggs or whether it is the first food of the newly hatched larvae. The liquid is covered by a thin film, probably of a resinous substance. We have tried to dissolve it, but it is not affected either by hydrochloric, acetic or any other kind of acid; caustic soda hardens it, and it is only with a 95% sulphuric acid that it can be dissolved with a great deal of difficulty.

The small egg-heaps may be isolated, or in groups of two or more. As soon as they are laid they are of a greenish colour, but after a week they turn brown and as the season advances they become increasingly

darker, but never becoming as dark as the bark of the branch on which they are laid. Even after two years or so reddish-blue marks can be found on the branches at the places where the eggs had been laid.

The following spring, with the stirring of the buds, the little heaps swell, the eggs increase in thickness so that it is possible to count them despite the fact that they are covered with the liquid and resinous film mentioned above. The date at which the eggs begin to hatch is most important for an effective and economic control of the insect, which consists mainly, as we shall see later, in forcing the newly hatched larvae to crawl in search of food over a strip sprayed with DDT at the right moment.

We have thus been able to ascertain both in 1949 and 1950 that the larvae begin to emerge toward the 22nd—25th March. The first egg to hatch is usually the centre one, which is the first to be laid, and the others follow on at short intervals, so that the whole family is very soon hatched; the house remains there, uncovered and made up of small empty rooms, but resistant to the weather for several years.

Though the time required for the hatching of the eggs of each heap is relatively short, it takes a long time for the eggs of all the heaps to hatch: we have noticed in fact that the clusters first laid hatch a month before those which were laid last and that the time required for all the larvae to hatch is as long as the period of emergence (of the adult) and egg laying, which is about a month. It is this factor which makes control more difficult.

The newly hatched larvae are white with a black shiny head, a common characteristic of all larvae of this group. Later on the colour changes according to the part of the tree on which they feed. The flowers which turn the larvae a yellowish-white colour are the favourite; if on the contrary they feed on leaves, the colour of their body becomes a dirty green; the larger ones can also feed on the young fruit, when they become a reddish-yellow.

All the larvae have the uncommon instinct to climb upwards. So that if the branch on which they hatched and first started their upward climb is turned upside down, instead of going up they will turn back; moreover, if they should reach the summit of a withered fruit-bearing shoot, they will rarely turn back, but instead they will frequently let themselves drop and hang by a silk thread in the wind until they come in contact with something green to eat.

The time of emergence of the larvae corresponds to that of the opening of the buds, in which the newly hatched larvae can immediately take refuge. Later on, for safety, they build themselves a silk house within the corymb. From there they start their destructive activity: in the flower buds, the first to be damaged, are the peduncles of the flowers in which they burrow galleries and gnaw the stems, nearly always near the calyx. After which neither the petals, leaves nor the young fruit are spared, and into these they make deep incisions.

In cases of heavy infestations the trees which are badly attacked have bare summits and can be seen a long way off because of the marked contrast with the lower parts of the foliage, which are never

so badly damaged. If a fruit has escaped the greed of the larvae, and is only slightly damaged, it looks diseased because of the pink marks which go right into the pulp, in contrast to those of the *Cacoecia* larvae, which are more superficial.

In the struggle for survival *Cacoecia rosana* has always come up against the natural difficulties of the surroundings, due to atmospheric agents, and the necessity of protecting itself from birds and predatory insects.

It is probably because of this that a special instinct of self-preservation has gradually developed and to such an extent that it is particularly difficult even for the farmer to protect the fruit of his labours from the damage caused by this pest. The hatching of the eggs occurs consecutively over a period of about one month, and the newly hatched larvae can live without food for 24 hours ; to obtain this they are capable of moving as far as 8—10 m. : which is equivalent to 5,000 times their own length. But for protection they need a house : the larvae reaches a bud which is about to open, it enters and with a silk thread it builds a small sheath, which becomes weaker as the grub grows larger and is less in need of protection. It remains in the bud so long as this has nourishment to offer, then it moves on to continue its devastating activity in another bud.

When the season is advanced and there are no buds nor flowers, but only leaves and fruit, the only refuge to be found is a leaf. The larvae, therefore, remain on the under-side of this so as not to be exposed to the rain and possible attack of enemies, and wraps the leaf around itself like a sheath by the usual method of silk threads attached to the extremities and veins. In this shell it prepares to become a chrysalis : it feeds on the leaf parenchyma, but often also on any fruit which might be ripening near its refuge : thus without spoiling its house and without coming out, except perhaps for the head, it grows and darkens until it reaches the chrysalis stage, when it is practically entirely enclosed in the sheath.

As with all *Tortricidae* (Klimesch), to which family *Cacoecia rosana* belongs, the chrysalis remains in its sheath, made from rolled up leaves and silk threads, until shortly before the emergence of the butterfly. Only then does the chrysalis push itself nearly full length out of the sheath by the aid of a row of small curved teeth placed on the segments of the abdomen, so that the butterfly finds the way free.

After a period of about 15 days, it will emerge as a butterfly : not a beautiful butterfly, but with fairly bright colours until copulation occurs, after which these lose their brightness and become pale and faded.

CONTROL

It appears to be clear from the above explanations that the fruit farmer is faced with an enemy difficult to exterminate. In fact :

(1) the stages of its life history are never constant in length, except as an overwintering egg ;

(2) it exposes itself as little as possible to the direct or indirect action of insecticides.

From research carried out in various districts on these two questions, the conclusion was reached that the best periods for the control of *Cacoecia rosana* are those when a maximum number of insects reach the same stage and when they are less protected and therefore more vulnerable. These periods may be reduced to three, namely:

(1) In the winter period, when *Cacoecia rosana* is to be found on the branches in the egg stage. We have tried to control it during this stage with ordinary mineral oils of varying concentrations, but with absolutely negative results; with dinitro cresol mineral oils, which gave positive results only if applied at a too advanced stage of vegetation, which may cause scorching, particularly to the *Grafenstein* variety before flowering and to the *Jonathan*, which absorbs a considerable amount of dinitro cresol through the hairs of its buds. Other tests made with yellow mineral oils heated and sprayed on the tree at the normal time of winter sprayings gave better results, but they were so unimportant as to make it impossible to bring them into general use. We can instead advise for this period the careful scraping and brushing of the branches with the aim of killing as many eggs as possible. In a small farm, this would give better results at lower cost.

(2) At the time of the hatching of the eggs (in the Bolzano district 22nd—23rd March) when the larvae, in order to reach the buds, crawl over several centimetres, or even as much as a metre or more. We can recommend at this period two sprayings at an interval of 6—8 days with DDT products (400 gr. of 50% DDT to 100 litres of water). This obliges the young larvae to crawl over an area which is deadly to them.

(3) Finally, a few days before the first flowering (near the opening, as when the flowers are joined together they already form a refuge). In this case even only one spraying carefully done and with a high concentration of phosphoric esters is deadly, even when some larvae are already hiding in the sturdier leaves.

TRANSLATION

NOTES ON WEED CONTROL IN FRANCE, WITH SPECIAL REFERENCE TO THE TREATMENT OF YOUNG LUCERNE

by MAURICE DUBUS (*Expert-agricole*)

THE progressive development on an international scale (especially in America and Britain) of technique in the use of selective weedkillers, based on 2,4-D or other hormones, has produced in recent years conclusive results, especially in the treatment of cereal crops. The investigators have never had unexpected disappointments and they are unanimous in the conclusion that every case of failure or accident is caused more by faulty application of the weedkiller than by the hormone itself.

It must be admitted, therefore, that the necessary reliable information leading to the institution of practical methods of weed control readily accepted by commercial users of the products has been obtained only by carefully conducted experiments accompanied by meticulous and regular observations since the discovery of the effects of hormone weedkillers on plants.

In addition to these well defined methods of weed control which have been widely accepted up to the present, there are certain problems which are not yet finally resolved. We should like to mention briefly one of them, which we feel sure would be of great interest to agriculturists, and which is concerned with weed control in cereal crops undersown with such herbage plants as lucerne and clover.

This question was discussed during the International Conference at Fernhurst in June 1951, which the writer had the honour of attending. As it was, unfortunately, not possible to discuss the subject fully then, the writer feels it incumbent on him to contribute the following notes.

Many technical articles in numerous agricultural journals have strongly advised against the autumn or spring application of weedkillers in cereal crops undersown with lucerne and clover. This

prudent advice is praiseworthy but it has not prevented some French farmers, particularly in northern districts, from attempting their own experiments.

The writer has closely followed several of these experiments and describes below the results obtained from those trials concerned with the treatment of young lucerne and clover. A merchant of Aubencheul-au-Bac (Northern France), M. Rigault (commission agent of "Produits Chimiques et Engrais d'Auby", associate of the French firm, SOPRA) has, during the last few years, laid out, in collaboration with farmers, trials of different treatments of oats and wheat undersown with lucerne and clover.

The treatments were carried out with the sodium salt of 2,4-D ('Chloroxone' 80% of SOPRA) and with the sodium salt of MCPA ('Agroxone' 10% of SOPRA). Absolutely satisfactory practical results have been obtained with the latter product in three different years of treatment. The lucerne and clover seed were sown with oats in March and April and were treated about the middle of May, that is, when the lucerne and clover plants were 8 to 10 cm. in height. Treatment was at the rate of 4 to 5 litres of 'AGROXONE' (MCPA 10%) per hectare by high volume spraying (800 to 1,200 litres of water) or by atomization (80 to 100 litres of water).

The results obtained were very conclusive and the method has now been adopted by many farmers.

Similar experiments were also carried out on the treatment of late seeded lucerne and clover 8 to 10 days after sowing. Suprisingly good results were again obtained, 100% success being achieved.

After the treatments there was a check in the growth of the young plants for about a fortnight, followed by a renewal of vegetative activity. The treated fields were examined during the succeeding years and lucerne plants were found to be showing exceptionally vigorous growth.

It must be specified that the treatments were carried out in mild weather with a minimum temperature of 8 to 10°C. under rainy and fine conditions and the writer is convinced that such treatments can be carried out in France without any danger.

It must be stated in conclusion that the use of the sodium salt of 2,4-D is definitely *not* advisable for weed control in lucerne and clover, but that the use of the sodium salt of MCPA, at the rate of 450 to 500 grammes of active product per hectare can be strongly recommended for this purpose in France.

The writer takes the opportunity of stating here that French agriculturalists are making more and more use of products marketed in liquid form which are readily applied by low volume sprayers and preferably by atomization. In France the firm SOPRA has put at the disposal of its clients very successful atomizers for this kind of treatment at a moderate cost.

TRANSLATION

TECHNICAL BREVITIES

This section includes information on plant protection problems in their widest sense, which has been obtained from published literature. We give references to the publications concerned.

INSECTICIDES

Cardamom Thrips Control.

The cardamom thrips, *Taeniothrips cardamomi*, which causes severe losses of cardamoms, is effectively controlled in South India by dusting at least once a month with 5% BHC. Spraying with 0.05% nicotine sulphate is also effective but very troublesome in the hilly areas, and the spray deteriorates if kept for more than a day. Inferior are nicotine sulphate dust, tobacco dust, and tartar emetic bait-spray.

Subbiah, M. S., Indian Fmg., 1951, **11** (5) : 183-7.

Coffee Bug Control.

Test sprayings on coffee in Tanganyika indicate that routine treatment with 0.05% DDT in 0.5 or 1% Bordeaux mixture at 160 gal. per acre carried out at the normal times for Bordeaux spraying may eliminate the *Antestia* bug in a very short time.

Notley, F. B., East Afr. Agric. J., 1951, **16** (3) : 131-2.

Corbie Grub Control.

After two seasons' trials in Tasmania against corbie grub, *Oncopera* spp., which is the principal insect pest of pastures, the preliminary recommendation is given to apply technical DDT at 1¼ lb. per acre in the normal superphosphate top dressing in autumn. This gives very good control. BHC and chlordane are not effective.

Tasm. J. Agric., 1951, **22** (1) : 29-30.

Fruit Tree Leaf Roller Control.

Spraying at the rate per acre of 300 to 500 gallons of water containing either 6 lb. DDT 50% wettable powder or 6 lb. DDD 50% wettable powder, or 3 lb. parathion 25% wettable powder is suggested for the control of the fruit tree roller, *Archips* (*Tortrix*) *argyrospila*, on citrus in California. Dust suggestions are 6% DDT or 5% DDD at 90 lb. per acre. Applications should be made immediately after all the eggs have hatched.

Atkins, E. L., Calif. Citrogr., 1951, **36** (6) : 246, 254.

Dicky Rice Weevil Control on Citrus.

Adults of the dicky rice weevil, *Maleuterpes spinipes*, cause serious damage to citrus in New South Wales by feeding on the skin of citrus fruit and on the foliage. They emerge from the soil in August to October and crawl up the trunks. Tree-banding is, therefore, recommended. When the weevils are active they should be sprayed with cryolite at 1¼ lb. per 40 gallons + 1 quart white oil emulsion, but if Bordeaux spraying is necessary, the incompatible cryolite should be replaced by DDT, using 1 gallon of 20% DDT emulsion to 400 gallons of spray.

Agric. Gaz. N.S.W., 1951, **62** (1): 42-3, 52.

Glyoxalidine for Red Spider Control.

Throughout four years of trials in Maine, spraying apple trees with glyoxalidine following pre-bloom lime-sulphur not only gave excellent control of scab but made the use of an acaricide unnecessary. On blocks receiving wettable sulphur instead of glyoxalidine several acaricidal applications were required to keep European red spider under even reasonable control. The mode of action of the glyoxalidine in red spider control is unknown. It seems fairly certain that it does not kill the pest. Possibly it allows male predators to increase or acts as a physical barrier to red spider feeding or egg-laying.

Hilborn, M. T., Amer. Fruit Grower, 1951, **71** (4): 22-3.

Pine Root Collar Weevil Control.

In Wisconsin, the pine root collar weevil, *Hylobius radicis*, the larvae of which can kill pine trees by feeding in the cambium region at the extreme base or in the larger roots near the trunk, can be practically wiped out by pouring 1 pint per tree of a BHC emulsion on the bark about 1 inch above ground-level or, more cheaply, by power spraying with BHC at 1 lb. gamma isomer per 1,000 trees at 2 quarts per tree. Less effective are ethylene dichloride, propylene dichloride, chlordane and DDT.

Shenefelt, R. D., J. Econ. Ent., 1951, **43** (5): 684-5.

Schradan as Systemic Insecticide.

In laboratory and field tests in Texas octomethyl pyrophosphoramide (schradan) acted systemically against cotton aphid, *Aphis gossypii*, when applied to cotton via the roots at 4 to 8 lb. per acre, or via foliage as a spray at 1 lb. per acre. It was also highly effective against mites and aphids on seedling cotton when applied to the seed at the time of sowing, using only 0.2 to 0.05 lb. per acre. It was highly specific for aphids and mites.

Ivy, E. E., et al., J. Econ. Ent., 1951, **43** (5): 620-6.

Onion Maggot Control: New Dusting Method.

Promising control of the onion maggot, *Hylemia antiqua* (*Delia Cepetorum*) was obtained in New York State by a dust containing 20% aldrin as insecticide + 20% thiram for onion smut control,

blown into the seed furrow at the time of sowing by means of a rotary duster attached to the seeder. A single application gave protection during the growing season.

Rawlins, W. A., & Newhall, A. G., J. Econ. Ent., 1950, **43** (6): 950-1.

Carrot Weevil Control.

Damage to carrots in Nebraska by the carrot weevil, *Listronotus oregonensis*, was reduced by 75% in plots treated with high gamma purified BHC. Regular dusting of plants and soil was made from the time plants were 2 inches high to maturity. A 5% DDT dust gave some reduction. Ineffective were methoxychlor, chlordane and toxaphene.

Bare, O. S., Rep. Neb. Agric. Exp. Sta., 1949, 1950 : 85.

Asparagus Hypopta Control.

In France control of the asparagus pest, *Hypopta caestrum*, is complicated as the larvae live deep in the soil and, owing to the presence of the crowns, only superficial soil working is possible and only non-phytotoxic chemicals can be used. DDT, BHC, SPC and chlordane are ineffective. Methyl bromide, calcium cyanide, paradichlorobenzene, carbon bisulphide and potassium sulpho-carbonate are unsatisfactory, mainly because of plant injury. Dibromoethane has shown some promise in summer treatments. The larvae are destroyed, however, without injury to plants by autumn injections of DD in 5 c.c. doses every 33 cm. along rows to a depth of 25 cm. Spring treatments retard growth. Pupal cells can also be destroyed by breaking down the ridges during the first sunny days in spring, or the cells may be collected by hand. Copious watering of the soil with parathion at 20 to 25 gr. per 100 l. at the end of June destroys the eggs. All three measures should be used.

Nepveu, P., and Benas, G., C.R. Acad. Agric. Fr., 1951, **37** (3): 134-5.

Garden Webworm Control.

In Nebraska, larvae of the garden webworm, *Loxostege similalis*, were reduced in numbers by BHC as a suspension at ½ lb. gamma isomer per acre, and by a DDT emulsion at 1 lb. per acre, but not by DDT dusts, or by chlordane or toxaphene.

Hixson, E., and Muma, M. H., Rep. Neb. Agric. Exp. Sta., 1949. 1950: 82-3.

Arsenic Absorption by Plants : Poisoning Hazard.

It has been shown in France that arsenicals are not absorbed from the soil by plants in amounts large enough to be a toxic danger to mammals even when the chemicals are applied at dosage rates ten times those used for the control of pests.

In pot experiments, sodium arsenate was applied to barley at arsenic levels in the soil of 100 to 400 kg. per hectare. At flowering time arsenic in the plant dry matter was found to be always less than

4 mg. per gramme, corresponding to less than 1 mg. per kg. of fresh vegetables or fruit, which is considered to be harmless.

Boischot, P., and Tyskiewicz, Mlle., Ann. Inst. Nat. Res. Agron. A., 1950, **1** (5) : 556-7.

DDT Residues on Currants and Gooseberries.

In Manitoba no significant residues were left on the fruit at harvest time when pre-bloom DDT sprays had been used against currant fruit fly. Only when two post-bloom sprays were applied at 2 to 3 lb. per acre did the residues approach the tentative tolerance level of 7.0 p.p.m.

Allen, W. R., et al., Sc. Agric., 1950, **30** (9) : 380-3.

Treating Beet Seed for Wireworm Control.

Equally satisfactory results were obtained from parallel experiments in Belgium in which (1) $C_6 H_6 Cl_6$ (BHC) (20% of the gamma isomer) was applied to the soil at the rate of 12 kg. per hectare and (2) the seed (28 lb. per hectare) was dusted with 0.6% of its weight of a product containing 20% of the gamma isomer and 1% of 'Agrosan.'

Ernould, L., (Inst. Betterave, Tirlemont, Belg.)

Pubs. inst. belge ameliorat. betterave, **18**, 95-106 (1950).

Chemical Absts., **45**, 7, p. 3111, 1951.

Orchard Pest Build Up.

A review of the results of orchard spraying with parathion in the U.K. in 1950 shows that where applications were made without regard to their effect on pest parasites and predators good control of red spider was obtained. It is advocated that the aim in keeping trees clean should be to spray for 100% kill of the pests. There would then be no need to bother about the predators. Parathion is efficient but it demands proper application, and this should be ensured, if need be, by altering planting methods, cutting out the risk to the spray gang, and doing the job mechanically.

Bush, R., Grower, 1950, **34** (15), 721-5.

White Grub Control.

In Virginia a 1% parathion dust applied to tobacco plant beds at 1 to 4 lb. per 100 sq. yards in the top 2 inches of soil was highly effective against larvae of the green June beetle, *Cotinis nitida*, infesting the beds. It was also effective when applied with fertilizer before seeding or as a surface spray at 1 lb. of 25% wettable powder per 100 gall. using 12.5 gall. per 100 sq. yards. Gamma BHC, aldrin, dieldrin, toxaphene, heptachlor, and chlordane were inferior.

G. B. Dominick, J. Econ. Ent., 1950, **43** (3) : 295-8.

Internal Chemotherapy by Seed Treatment.

Some protection from aphid and red spider attack is given to certain plants by soaking the seeds before planting in an aqueous solution of schradan. In pot experiments with broad beans from seed soaked

for 24 hours in 0.5% schradan, for example, aphid kills fell slowly from 100% on the 9th day after germination to 85% on the 36th day, dropped to 30% on the 43rd day, and to 17% on the 60th day. Cotton, pea, various beans and nasturtium were similarly protected from aphids and red spider. Concentrations of 2% were phytotoxic except to nasturtium, which tolerated 5%.

Tsi, C. S., Nature, Lond., 1950, **166** (4230) : 909-10.

Biology and Control of Cutworms and Armyworms in Florida.

Destructive cutworms of many species are readily controlled by normal seedbed applications of DDT used for mole cricket control.

Southern armyworm (*Prodenia eridania*) was controlled by DDT and Chlordane, BHC being not effective.

DDT dusts and sprays were ineffective against fall armyworm (*Laphygma frugiperda*) on sweet corn, which was effectively controlled by methoxy-DDT applied, as a 3% dust twice with a 3 week interval, in the leaf whorls of sweet corn plants.

In trials on maize 10% toxaphene and 1% parathion were outstanding for *L. frugiperda* control, and on grain sorghum 10% toxaphene, 0.5% parathion and 5% methoxychlor were the most effective of the insecticides used for *L. frugiperda* control, though the leaves of toxaphene-treated plants showed moderate phytotoxic symptoms.

Further trials showed that poison bait treatments were superior to spray or dust treatments against *L. frugiperda* attacking maize. The successful poison baits contained as their toxic ingredient parathion at a rate of 1 lb. per 800 lb. wheat bran (which were applied by throwing small pinches into the leaf whorls), giving excellent control, as did baits incorporating DDT, 5% chlordane, and 5% chlorinated camphor.

Kelsheimer, E. C., and others, Florida Univ. Agric. Expt. Sta. Ann. Repts. for the Fiscal years ending June 30, 1947, 1948 *and* 1949. (*In Field Crop Absts.*, **4** : 1, *Jan*, 1951, *No.* 63).

Control of Green Peach Aphis.

DDT (emulsion), HETP, and E 605 gave very good control of a severe aphis (*Myzus persicae*) infestation in spring treatment trials in South Australia. DDT in wettable powder form failed to control the aphis.

Harris, W. B., J. Dept. Agric., S. Austr., 1950, **53** : 443-5.
(*Abstd. in Hort. Absts.* **21** : 1 : *Mar.*, 1951, *p.* 50).

Gamma—BHC Seed Treatment : Phytotoxicity to Cereals.

Although gamma-BHC at levels up to 1,000 ppm. on seed of wheat, barley, and oats had little or no adverse effect on germination or early growth in the field or in box tests in soil, abnormal growth occurred in germination tests on filter paper and in sand at doses of 250 and 500 ppm., which are the amounts used for wireworm control at seeding

rates of 4 to 2 bushels per acre respectively. The appearance of abnormalities in germinating tests of seed dressed with gamma-BHC does not, therefore, necessarily imply unsuitability of the seed for use in the field.

Jameson, H. R., and Callan, I. W. McC., Nature, Lond., 1951, 167 (4247): 490.

Buprestid Beetle Control on Perfumery Roses.

In the Grasse region of France, larvae of buprestid beetles, notably *Agrilus aurichalceus* and *Coraebus rubi*, cause serious damage to the May rose, *Rosa centifolia*, which is grown for perfume making. The chief damage is to the suckers used for propagation, sometimes up to 80% of which may be lost, but branches of older plants are galleried and may be killed. Laboratory tests showed that complete kills of adults of both species were given by dusts containing 8% technical BHC or 1% parathion, but BHC was preferred in practice as it seemed to have a repellent effect and was more economical. Excellent results were obtained in the field by 4 to 5 dustings of BHC from May to July, giving the first after collection of the flowers (lest quality of the perfume may be affected) and the others at 10 to 15 day intervals. Yield of flowers was sometimes doubled after treatment, and the 3 to 4% of suckers attacked, compared with 20 to 30% in controls, were those on which eggs had been laid before or during harvesting of flowers. Treatment must be regularly applied to old bushes, as it does not affect suckers already infested. Chemical treatment must not be given during harvesting of flowers.

Pussard, R., C.R. Acad. Agric. Fr., 1951, **37** (7): 265-6.

Fruit Fly Control.

For control of the Mediterranean fruit fly, *Ceratitis capitata*, attacking navel oranges in Algeria, two or three sprayings of DDT at 250 grm. per hectolitre are recommended, giving the first in September and the others at intervals of 2 to 3 weeks. Accurate timing and thorough coverage are important. During the main flight period bait traps should be used containing 4% ammonium phosphate as attractant. Treatment may cause build-up of *Diaspis* scale, against which white oil sprays and HCN fumigation should be used.

Martin, H., and Alibert, H., C.R. Acad. Agric. Fr., 1951, **37** (3): 129-31.

FUNGICIDES

Bacterial Spot of Plum Control.

In New Zealand satisfactory control of bacterial spot of plum, caused by *Xanthomonas pruni*, was obtained without serious foliage damage by two sprayings of Bordeaux 2-4-100 followed by two of 3-6-100. Neither lime sulphur nor ferbam was of any value.

Reid, W. D., N.Z. J. Sci. Tech. A., 1950, **31** (5): 40-3.

Apple Scab Control: Alternative to Lime-Sulphur.

If shortage of sulphur makes replacement of lime-sulphur necessary in fruit spraying in the U.K., it is suggested that use might be made of ferbam at 3 lb./100 gallons as a summer spray or thiram at 2 lb./100 gallons, each having a sulphur content about half that of a 1% lime-sulphur spray. Ziram cannot be recommended until more is known of its safety on U.K. varieties. A sulphur-free material for scab control in use in the U.K. is phenyl-mercury-chloride which at 0.005% is roughly as effective as 1% lime-sulphur without injury to varieties other than Cox's Orange Pippin. A glyoxalidine preparation has proved effective in England at 1 qt. per 100 gallons and less injurious to sulphur-shy varieties than lime-sulphur.

Marsh, R. W., Agriculture, 1951, **58** (1): 22-4.

Papaya Fruit Rot Control.

A rot of papaya fruits in Assam, caused by *Ascochyta caricae*, is described. Control is given by thorough spraying of the fruits with Bordeaux mixture 2 : 2 : 50 at intervals of 21-30 days from time of setting.

Chowdhury, S., Trans. Brit. Mycol. Soc., 1950, **33** (3 & 4): 317-22.

"Field Results in 1949 Following Row Treatment of Soil with Tetramethyl Thiuram Disulphide for Control of Blackroot of Sugar Beet Seedlings".

Field tests in Ontario showed that the addition of formulations of tetramethyl thiuram disulphide mixed with standard commercial fertilizer to field soils with a recent blackroot history resulted in increased stands of seedlings in the treated rows, as disclosed by both pre- and post-thinning counts of seedlings. The increases in the stands of seedlings in treated rows was followed by increased yields of mature beets as compared with the yields in untreated rows.

Hildebrand, A. A., and McKeen, W. E., Proc. Amer. Soc. of Sugar Beet Technologists, 1950, *pp.* 515-518.

Seed Treatment of Vegetables.

In greenhouse and field tests on various vegetable seeds, thiram, tetrachloro-p-benzoquinone and l-p-sulphamylphenyl-3 : 5-dimethyl-4-nitrosopyrazole (36 L) were more effective as seed protectants and in controlling pre-emergence damping-off than cuprous oxide (cuprocide), methyl mercury dicyandiamide (Panogen), ferbam or zinc trichlorophenate (Dow 7B). Addition of hormones, insecticides, or nematicides did not improve emergence. Under glass, emergence was lower at 5 to 12°C. than at 16 to 20°C., and was optimum at 45% water-holding capacity of soil. In the field, watering after sowing improved emergence in relatively dry soils, but decreased emergence in moist soils. Seed treatment was more beneficial for peas than other vegetables. Treated seed stored dry for 10 months gave better emergence than untreated seed.

Jacks, H., Ann. App. Biol., 1951, **38** (1): 135-68.

Controlling Pineapple Disease of Sugar-Cane.

Results of extensive tests carried out at the Hawaiian Sugar Experiment Station with more than 60 fungicides for the control of pineapple disease of sugar-cane (*Ceratostomella paradoxa*) showed that the best control of the inoculated setts is by pyridylmercuric acetate, pyridylmercuric chloride and phenyl mercuric acetate (PMA), the last-named of which proved least expensive on a field scale. One quart PMA per 100 gallons water is the recommended strength for dipping or spraying cuttings. Cuttings should be treated when planted under unfavourable germination conditions.

Wismer, C. A., Hawaii. Plant. Rec., **54**, 1, 23-53, 1951. *R.A.M.* *XXX*: 11: 582: 1951.

Control of Pineapple Disease of Sugar-Cane Setts.

The undoubted value of dipping sugar-cane setts in a mercurial solution as a means of controlling pineapple disease (*Ceratostomella paradoxa*) in the Lower Burdekin district was again demonstrated by the results from experimental plots in the 1949 planting season.

From the Fiftieth Ann. Rept. Bur. Sug. Expt. Stations, Qld., 54 pp., 1950. *R.A.M.*, *XXX*: 11: *Nov.*, 1951: 582.

Soil-Borne Disease of Sugar Beet Control: Thiram as Side-Dressing.

In Nebraska application of 50% thiram at 5 lb. per acre on each side of sugar beet seed increased stand by 80% on land heavily infested with damping-off and root-rot organisms. The chemical also had a residual effect: 10% more treated plants survived after thinning than untreated, and 92% greater yield resulted.

Schuster, M. L., Neb. Agric. Exp. Sta. Rep., 1949. 1950: 67-8.

WEEDKILLERS AND HORMONE PRODUCTS.

Spraying to Destroy Bushes.

Because of their qualities of rapid penetration, the esters of 2,4-D have proved most effective for destroying bushes. Sodium chlorate at 50—80 kg. per hectare is more effective than 2,4-D, however, in the control of heather and whortleberry.

Hofsten C. G. von, Lantm. Svenskt Land, 1950, **34**, 771-2.

Herbage Absts., **20**, 4, *Nov.*, 1950: 206.

Control of Weeds in Clover Undersown Oats.

Satisfactory weed control was obtained in clover undersown oats, 7 inches high, by applications of $\frac{1}{4}$ lb. of the amine and $\frac{3}{8}$ lb. of the sodium salt of 2,4-D per acre. The clover seedlings were undamaged by these treatments but were damaged by the application of $\frac{1}{8}$ lb. of the ester of 2,4-D, which did not give good weed control.

Pennsylvania Agric. Expt. Sta. Bull., 515, *Science for the Farmer*, 62*nd. Ann. Rept. State College*, 1949, *pp.* 66.

Herbage Absts., **20**, 4, *Nov.*, 1950, *p.* 228.

2,4-D Eradicates Water Hyacinth.

The application of 2,4-D at the rate of 6 lb. of the acid (dispersed as amine salt) in 150 gallons of water per acre controlled *Eichornia crassipes*.

Edward C. Greco (*United Pipe Line Co., Shreveport, La.*) *Oil Gas J.*, **49**, *No.* 36, 85 (1951).

Chem.Absts., **45**, 6, *Mar.*, 1951, *p.* 2618.

Use of IPC for Weed Control in Sugar Beets.

Investigations carried out in 1949 in Colorado have shown that application of IPC, dry and worked lightly into the surface of the soil, at the rate of 10 lb. or more per acre just prior to planting sugar beets, effectively controlled monocotyledonous and broad leaved weeds which would otherwise have germinated with the sugar beet and thus seriously checked the growth of the crop. With favourable conditions for seedling emergence and early growth the 10 lb. surface application of IPC just before planting resulted in adequate thinned stands and as good a yield as the untreated check when the crop was sown at the rate of 4.3 pounds of sheared sugar beet seed per acre. Treated plots gave a stand of only about $^2/_3$ that of the untreated plots, with an accompanying apparently reduced root yield, when the seeding rate was 2.3 lb. sheared seed per acre. Further trials of this chemical as a pre-emergence soil treatment for weed control in the pre-thinning period of the sugar beet crop are warranted,

G. W. Deming, Proc. Amer. Soc. of Sugar Beet Technologists, 1950 : *pp.* 453-455.

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